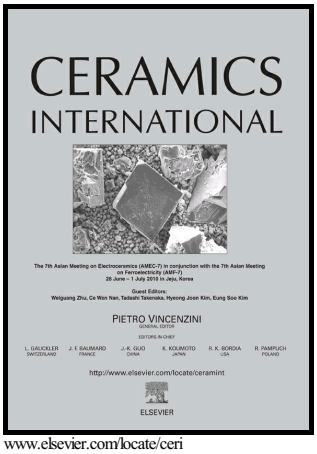

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Splitting of glass and SiC ceramic sheets using controlled fracture technique with elliptic microwave spot

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Abstract

This paper presents an alternative splitting method of both thick glass (transparent material) and Sic ceramic (non-transparent) sheets without causing removal of material based on controlled fracture

technique with elliptic microwave spot. This method is called as MISM (Microwave Induced Split Method) for short. First, the fact of that 2.45 GHz microwave could volumetrically heat 10-mm thickness NaCa glass and Sic ceramic sheets is theoretically proved. Then MISM physical model and corresponding apparatus is developed. Simulating of distribution of power loss density of microwave spot in the physical model is performed. Simulating results shows that an elliptic volumetrically heating microwave spot is obtained, which is testified by measured temperature distribution on the input and output surface of sheet. NaCa glass sheets with max thickness of 4 mm and Sic sheets with max thickness of 3 mm are both split without causing removal of material. The split line is straight. The split procedure is as same as the procedure of controlled fracture technique with laser spot. The sub-processes of split were related with the movement of three parts of elliptic microwave spot.

Keywords: focusing microwave; glass; ceramics; controlled fracture technique; cutting

1 Introduction

The splitting of glass and SiC ceramic plates is an important manufacturing process. However, existing methods (such as mechanical splitting [1], electric spark splitting[2], laser melting splitting [3], water guiding laser splitting [4] and underwater laser splitting [5]) suffer from the disadvantages of high cost, low efficiency, poor splitting surface, high energy consumption and debris pollution, among others. The growing use of glass and SiC ceramic plates in the military, aviation, IT and LCD fields necessitates a better method that overcomes these disadvantages.

The TISM (thermal induced splitting method), which satisfies those demands, was invented by American researcher Lumley in 1967[6]. Lumley used a laser to heat a glass plate from edge to internal region. He found that the thermal stress caused by this heating process drives an initial flaw on the edge to crack along the heated path. The plate is split into two parts when the initial flaw